REMARKS

In the Office Action, the Examiner withdrew claims 13-18 and 24 due to a restriction requirement. Claims 13-18 and 24 have been cancelled, but may be pursued in a divisional application. Claims 9 and 20 have been cancelled, and claims 1, 19 and 21 have been amended. Applicants respectfully request reconsideration of the rejections of claims 1-12, 19-23, and 25, including independent claims 1, 19, 21, and 25.

The Examiner rejected claims 1-3, 6-8, and 21 pursuant to 35 U.S.C. §102(b) as anticipated by Pan (U.S. Patent No. 6,322,509). Claims 1, 2, 4, 5, 11, 19, and 20 were rejected pursuant to 35 U.S.C. §102(b) as anticipated by Mo '077 (U.S. Patent No. 6,251,077). Claims 1, 9, 10, 21-23, and 25 were rejected pursuant to 35 U.S.C. §102(e) as anticipated by Mo '967 (U.S. Patent No. 6,577,967). Claims 1-12, and 19-21 were rejected pursuant to 35 U.S.C. §102(e) as anticipated by Bakircioglu (U.S. Patent No. 6,733,454).

Independent claim 1 has been amended to include the limitations of claim 9. In particular, claims 1 recites firing at least first and second sequences of spectral Doppler pulses in response to first and second different settings of the spectral Doppler parameter, respectively, determining at least first and second goal values in response to the first and second sequences, respectively, estimating a change of a spectral Doppler parameter as a function of the first and second goal values, and automatically setting, at a third setting the same or different than one or both of the first and second settings, the optimal spectral Doppler parameter as a function of the estimated change.

Mo '967 and Bakircioglu are the only two references cited against claim 9. Mo '967 and Bakircioglu do not disclose these limitations.

Mo '967 adjusts the polarity and position of the velocity scale and the pulse repetition rate based on analysis of signals (abstract; and col. 2, lines 49-54). Received signals are used to determine the power spectrum, providing velocity (frequency) verses time (col. 3, line 65-col. 4, line 1; and col. 4, lines 8-15). The spectrum is divided into rows and columns (col. 6, lines 10-15; and Fig. 5). The rows of the spectrum are checked for proper data bandwidth so that the PRF may be increased as needed (col. 6, lines 43-46). After noise processing, edges

along the rows at the first transition between noise and signal are identified (col. 7, lines 34-47; and Figs. 6A-6D). Depending on the edges, the pulse repetition frequency may be adjusted (col. 8, lines 43-63). The pulse repetition frequency is set to provide the desired number of rows of signal as opposed to noise (e.g., 75%) (col. 8, lines 49-56). The desired setting is given by the current velocity range based on the number of signal rows divided by the desired number of rows fraction (e.g., 75%) (col. 8, lines 43-54). The polarity is set, and the baseline is set based on the row count (col. 8, line 64-col. 9, line 12).

Mo '967 sets the parameter based on a spectrum acquired at one setting (col. 6, lines 43-65). The entire spectrum is acquired after adjustment for noise and before automated determination of the optimum parameters (col. 6, lines 59-60). Mo '967 estimates a change or setting based on edges in a spectrum for a current setting. Mo '967 does not fire at least first and second sequences of spectral Doppler pulses in response to first and second different settings of the spectral Doppler parameter, respectively, determine at least first and second goal values in response to the first and second sequences, respectively, and estimate a change of a spectral Doppler parameter as a function of the first and second goal values. Mo '967 does not use multiple goal values associated with transmissions at different settings of the parameter to estimate the change of the parameter. The change is not a function of the two goal values from different settings.

Bakircioglu also provided automated optimization of the pulse repetition frequency based on the signal envelope (abstract). An optimum setting for one or more parameters is determined based on the signal acquired at a standard or predetermined setting of the parameter (col. 1, line 53-62; col. 3, lines 6-13; col. 5, lines 10-15; and col. 6, lines 30-40). For example, the pulse repetition frequency is set to be the greatest possible as the predetermined setting (col. 6, lines 41-43) and the gain is set to zero (col. 6, lines 54-58). The spectral information is acquired based on the predetermined value of each of the different parameters (col. 7, lines 7-13). Based on data for a heart cycle or other time period acquired with the standard or predetermined setting, the optimized values are set (col. 3, lines 14-23). The maximum or minimum velocity of the spectrum is determined (col. 7, lines 27-29). The maximum and minimum or other signal information is used to set the parameter value for each of the different parameters (col. 10, line 64-col. 11, line 20). For example, the

pulse repetition frequency is weighted by (the maximum velocity minus the minimum velocity)/128 (col. 11, lines 39-43).

Bakircioglu uses one setting (predetermined or standard setting) for each parameter to acquire a spectrum over time. The resulting spectrum is used to determine the optimum value for each setting. Bakircioglu provides a current setting and determine another setting. Bakircioglu does not fire at least first and second sequences of spectral Doppler pulses in response to first and second different settings of the spectral Doppler parameter, respectively, determine at least first and second goal values in response to the first and second sequences, respectively, and estimate a change of a spectral Doppler parameter as a function of the first and second goal values. Bakircioglu does not use multiple goal values associated with transmissions at different settings of the parameter to estimate the change of the parameter.

Independent claim 19 has been amended to include the limitations of claim 20. In particular, claims 19 recites firing at least one Doppler pulse into an identified region, automatically setting transmit frequency, filter settings, or combinations thereof in response to an echo signal from firing, and estimating a first setting from previous settings, wherein setting comprises automatically setting as a function of the estimated first setting. Mo '077 and Bakircioglu do not disclose these limitations.

Mo '077 mentions previous gain control and filtering (col. 3, lines 22-40). Adaptive noise-reduction filters may be improved by having a cutoff frequency which adjusts as a function of the flow signal spectrum characteristics (col. 4, lines 1-7). The cut-off frequency is set to a desired level (e.g., 20%) above the maximum frequency (col. 5, lines 45-52). Mo '077 sets the filtering based on the data, so do not disclose estimating a setting from a previous setting and setting as a function of the estimated setting.

Bakircioglu does not set the transmit frequency or filter settings.

Independent claim 21 recites a processor operative to determine at least first and second values in response to the first and second sequences, respectively, estimate a change of a spectral Doppler parameter as a numerical optimization function of the first and second values, and automatically set the spectral Doppler parameter as a function of the estimated change. The cited references, Pan, Mo '967, and Bakircioglu, do not disclose these limitations.

Mo '967 determines the optimal setting by weighting the current setting with a scale factor (col. 8, lines 43-54). The scale factor adapts to the spectrum (col. 7, lines 40-45). Mo '967 estimates the change by calculating a scale factor based on the signal edges closest to the baseline (Figs. 6A-6D). There is no suggestion for a numerical optimization function.

Similarly, Bakircioglu determines the optimal setting from the signals returned from one setting. A weight is applied to the current setting for pulse repetition frequency (col. 11, lines 39-43). The maximum signal and noise based on the current setting are used to map the dynamic range (col. 12, lines 25-56). The gain is set to center the dynamic range between thresholds (col. 12, lines 57-62). Bakircioglu estimates the changes by applying specific functions or formulas to the current setting (pulse repetition frequency), or based on thresholds (dynamic range and gain). Bakircioglu does not disclose a numerical optimization function.

Pan automatically adjusts gate position, scan line angle, and size based on image data (abstract). The vessel size, length, area or other characteristic is used to set the position (col. 8, lines 10-23). The image data may be binarized (col. 8, lines 41-45) and a center of the desired vessel is located (col. 10, lines 45-67). The image data is also used to determine the orientation for scan line angle and the diameter for gate size (col. 11, lines 11-17). Image information (B-mode or 2D Doppler) is used to set the position, size and angle. Pan does not disclose numerical optimization. Pan does not use values responsive to spectral Doppler sequences to estimate the change.

Independent claim 25 recites adaptively performing zero or more iterations of acts based on the first and second goal values. Mo '967 does not disclose this limitation. As discussed above, Mo '967 acquires a spectrum over a time period using the current parameter value. An optimized parameter value is obtained by weighting the current value based on a frequency bandwidth associated with the spectrum acquired with the current value. Mo '967 does not use an iterative process. The number of iterations is not based on goal values acquired in response to different firing sequences. Mo '967 does not adapt the iterations based on the goal values.

Dependent claims 2-8, 10-12, and 22-24 depend from claims 1 and 21, and are allowable for the same reasons as the corresponding base claim. Further limitations patentably distinguish from the cited references.

Claim 6 recites numerically optimizing the spectral Doppler parameter without full sampling. As discussed above for claim 21, the cited references do not use numerical optimization.

Claim 8 recites estimating a vector corresponding to two different spectral Doppler parameters and setting both parameters as a function of the vector. Pan uses a vector to set the scan line angle. The vector is a 2D image based vector. The vector does not correspond to two different spectral Doppler parameters and two parameters are not set as a function of the vector.

Claim 10 recites a spectral intensity sum. Mo '967 discloses spectral intensities, but there is not specific citation to a spectral intensity sum. Bakircioglu calculates maximum and minimum velocity, but there is no specific citation to a spectral intensity sum.

Claim 11 recites goal values as spectral signal-to-noise sums. Mo '077 reduces noise, but there is no specific citation to spectral signal-to-noise sums. Bakircioglu calculates maximum and minimum velocity, but there is no specific citation to spectral signal-to-noise sums.

Claim 12 recites determining the different goal values over at least one heart cycle and from different heart cycles. Bakircioglu uses a spectrum from a heart cycle, but does not determine different goals from different heart cycles where a change in the parameter is estimated from the goal values.

Claim 22 recites adaptive iterations, so is allowable for the same reasons as claim 25. Claim 23 is allowable for similar reasons.

CONCLUSION:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call the undersigned at (650) 943-5330 or Craig Summerfield at (312) 321-4726.

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